

REMARKS

I. Amendments

Claim 1 is amended to incorporate, essentially, the limitations of claims 3 and 4 therein. Further amendments to claim 1 are to provide for better clarity.

Claim 1 now recites a process that includes water removal from a hydrocarbon stream using a specified zeolite followed by sulfur removal using another specified zeolite and then regeneration thereof using a regeneration gas that contains water.

As a result of the amendments to claim 1, claims 2-4 are canceled.

Independent claim 7 is amended to incorporate, essentially, the limitations of dependent claim 9 that are written in a revised form in order to add clarity. Claim 9 is, therefore, canceled.

Claim 13 is canceled.

Independent claim 14 is amended to incorporate the limitations of claim 17. Claim 17 is, therefore, canceled.

Claim 15 is canceled.

Independent claim 20 is amended to incorporate the limitations of claim 22. Claim 22 is, therefore, canceled.

II. Objections

It is submitted that the Examiner's objections to the specification and claims have been addressed by the amendments.

III. §112 Rejection

It is submitted that the amendments to the claims have obviated this rejection.

IV. Prior Art Rejections

The Examiner has presented a total of six prior art rejections, which are listed as follows:

(1) §102 Rejection of claims 1-2, 7, and 13-15 as being anticipated over Eck et al. (US 3,470,677).

(2) §102 Rejection of claims 1-3, 7, and 13-16 as being anticipated over UK patent application (GB 2275625).

(3) §102 Rejection of claims 1-3, 7, 13-16 and 20 as being anticipated over Sherman et al. (US 4,329,160).

(4) §102 Rejection of claims 1-3, 7-8, 13-16 and 20-21 as being anticipated over Turnock et al. (US 3,620,969).

(5) §103(a) Rejection of claims 4-6 and 17-19 as being obvious over GB '625 in view of Gingrich et al. (US 6,074,459)

(6) §103(a) Rejection of claims 8-12 and 21-25 as being obvious over Sherman et al. in view of Gingrich et al. together with Turnock et al.

Among the six rejections, it is submitted that the amendments to the claims have eliminated as issues in the prosecution of the application the §102 rejections. Thus, the following remarks only address the Examiner's two §103(a) rejections.

§103(a) Rejection of claims 4-6 and 17-19 as being obvious over GB '625 in view of Gingrich et al. (US 6,074,459)

The GB '625 patent teaches a process for removing hydrogen sulfide and organic sulfur from a gas stream by first passing it to an absorber system by which it is contacted with an aqueous absorbent to remove hydrogen sulfide and mercaptans therefrom. The thus-treated gas having a decreased content of hydrogen sulfide and mercaptans is then passed to an adsorbent system whereby it is contacted with a solid adsorbent such as a molecular sieve to remove additional mercaptans therefrom to provide a purified gas stream. The solid adsorbent is thereafter regenerated using a bleed stream of the purified gas stream.

The Gingrich patent teaches a process for removing contaminants from a gas stream by the use of four sequential beds of solid adsorbents. The first bed of adsorbent is used to remove water and the following beds are used to remove various types of sulfur compounds and other contaminants.

The Examiner argues that it is obvious to modify the GB '625 publication by combining the first bed adsorbent of Gingrich with certain of the beds of the GB '625 publication. The Applicants, however, submit that the teachings of the cited references do not allow such a combination. The process of the GB '625 publication only uses a single bed of adsorbent in a second step that follows a first liquid absorption step. While GB '625 discloses a second step that includes several beds of adsorbent, one of the beds undergoes regeneration by use of a bleed stream from the purified gas yielded from the other bed. The first step of the process of GB '625 uses an aqueous absorbent solution to remove hydrogen sulfide and mercaptans from the gas stream. The use of the aqueous absorption solution would have the tendency to add water to the gas stream that is to be treated rather than removing water therefrom. There is no suggestion in the two cited references that they are combinable.

The Applicants' process, as it is now claimed, includes a first step of removing water from a gas stream using a specified solid adsorbent followed by sulfur removal using a second specified solid adsorbent followed by the regeneration of the second specified solid adsorbent using a regeneration gas stream that contains a concentration of water. Neither of the individual references nor a combination of the references discloses or teaches such a process. The GB '625 publication does not teach a water removal step and, indeed, its first absorption step may, in fact, add water to the stream being treated. Moreover, the GB '625 publication does not suggest the possibility of using different types of molecular sieves for functionally different process steps.

§103(a) Rejection of claims 8-12 and 21-25 as being obvious over Sherman et al. in view of Gingrich et al. together with Turnock et al.

The Sherman patent teaches a process that includes a first adsorption step whereby a hydrocarbon gas stream that contains impurities, which may include water, is contacted with a molecular sieve adsorbent bed. This adsorbent bed can subsequently undergo a desorption step whereby the molecular sieve adsorbent is contacted with a hot purge gas that comprises a portion of the purified gas. Water may be injected into the hot purge gas. There is no teaching by the Sherman patent of a step to remove water from the hydrocarbon gas stream prior to contacting it with the molecular sieve or of the use of different types of molecular sieves for functionally different process steps.

The Turnock patent teaches a process that includes a first adsorption step whereby a liquid hydrocarbon containing sulfur compounds is contacted with a molecular sieve that adsorbs

the sulfur compounds, and, thereafter, desorbing the sulfur from the molecular sieve using a hot purge gas stream that can contain moisture. There is no teaching by the Turnock patent of a step for removing water from the hydrocarbon gas stream prior to contacting it with the molecular sieve or of the use of different types of molecular sieves for functionally different process steps.

The Gingrich patent teaches a process for removing contaminants from a gas stream by the use of four sequential beds of solid adsorbents. The first bed of adsorbent is used to remove water and the following beds are used to remove various types of sulfur compounds and other contaminants.


There are no teachings within the references to suggest their combination, and, furthermore, even if the three references could be combined, they cannot be combined in a manner so as to provide the Applicants' claimed invention. The Applicants' claimed process includes a first step of removing water from a gas stream using a specified solid adsorbent followed by sulfur removal using a second specified solid adsorbent followed by the regeneration of the second specified solid adsorbent using a regeneration gas stream that contains a concentration of water. None of the three references, either individually or in combination, discloses the particular arrangement of process steps and functions as claimed by the Applicants.

V. Conclusion

In view of the amendments to the claims and the above comments, it is respectfully submitted that claims 1, 5-8, 10-12, 14, 16, 18-21 and 23-25 are patentable over the prior art. Early allowance thereof is therefore respectfully requested.

Respectfully submitted,

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